

ARGUMENTS

At the time the Office Action issued, claims 1-15, 17-30, 34-75 were pending. Applicants thank the Examiner for his diligence and thoroughness in preparing the present action.¹

Claims 49 to 63 have been allowed, for which the Examiner is respectfully thanked.

The Examiner has also indicated that dependent claims 13, 19, 26-30, 40, and 48 would be allowable if re-written in independent form. Applicant agrees, but has chosen not to rewrite these claims in independent form at present, in view of the arguments presented below, which show that none of the rejections made on the base claims are supported by the art and that no *prima facie* case of obviousness has been established regarding any one of the base claims.

Rejections made in Numbered Paragraph 4 of the Office Action

Claims 1, 4-5, 20-21, 23, and 25 have been rejected under 35 USC § 102(b) as anticipated by Yugeswaren (US Pat. 7075215 – hereinafter Yugeswaren).

Applicant respectfully traverses this rejection for the following reasons.

First, Yugeswaren does not disclose “an apparatus for acoustically analyzing a fluid,” as set out in the preamble of claim 1. While Applicant acknowledges that the preamble does not necessarily limit the claim, in the present case, the shortcomings of the cited reference are captured in the disparity between the preamble of claim 1 and the teachings of Yugeswaren. Yugeswaren teaches a tool for measuring the properties of a subterranean borehole, whereas the present tool measures properties of a fluid.

Importantly, the acoustic sensors 120 of Yugeswaren are directed outward, toward the borehole wall, and the reflection of the acoustic signals off the borehole wall provides information about the borehole. There will typically be fluid in the annulus between the outside of the tool and the borehole wall, and the acoustic

¹ Applicants recognize that the present case has a large number of claims and appreciate the Examiner's efforts to address every claim. Nonetheless, the status of some of the claims is not made clear in the office action. Specifically, claim 24 is not addressed, claims 49, 50 and 51 appear to be both allowed and rejected, and specific rejections are made against claims 34, 49, 64 and 65 although those claims are not listed in the rejections set out in the numbered paragraphs of the office action. Applicants have attempted to address the issues raised in the office action as understood.

signals sent by the sensors of Yogeswaren travel through that fluid, but the tool of Yogeswaren is not used to measure properties of that fluid.

By contrast, the device of claim 1 requires that the acoustic signal pass through the fluid inside the chamber. In this way, an acoustic path of known length can be used, and travel time of the acoustic signal along that length can be used to calculate, *inter alia*, fluid density. The device taught by Yogeswaren simply cannot be used for the purpose set out in the preamble of claim 1.

Looking beyond the preamble, the device of Yogeswaren lacks several elements that are recited in claim 1. These include:

- a chamber for holding the fluid
- a transmitter positioned within the chamber for transmitting an acoustic signal through the fluid, and
- a reflector positioned within the fluid for reflecting the acoustic signal.

With respect to the first item, it cannot be stated that pipe 105 of Yogeswaren is a chamber for holding the fluid. One of ordinary skill reading claim 1 would understand that “the fluid” referred to is *the fluid that is being analyzed*. Yogeswaren’s device sends acoustic signals outward from the tool. Pipe 105 of Yogeswaren holds “fluid,” i.e. fluid that is being pumped downhole, but that fluid is acoustically isolated from the acoustic devices 120. Therefore, Yogeswaren does not have a chamber that holds the fluid [that is being analyzed].

With respect to the second item of these, Yogeswaren’s transmitters (acoustic sensors 120) do not transmit an acoustic signal “through the fluid.” Applicants respectfully submit that an ordinary reading of claim one would relate the fluid of the second element to the fluid recited in the first element, i.e. the *fluid in the chamber*, which is also the fluid that is being analyzed. Nonetheless, to clarify this point, claim 1 has been amended to recite it explicitly.

With respect to the third item, the backing element 160 of Yogeswaren is simply not a reflector. As stated by Yogeswaren at col. 4, ll. 4-6, “The acoustic sensors 120 may optionally further include a backing layer 160 *for substantially attenuating acoustic energy reflected back into the tool 100.*” (emphasis added). In the field of acoustics, attenuation and reflection are essentially opposite in nature; while the object of an attenuator is to reduce or eliminate the strength of a signal, the object of a reflector is to re-direct it—typically without attenuating it. Nonetheless,

Applicant has also amended claim 1 to recite that the reflector reflects the signal *through the fluid in the chamber*, so as to more clearly illustrate the distinctions between the present device and that of Yogeswaren.

Lastly, because the present devices and those of Yogeswaren are directed to completely different purposes, namely one measuring the properties of a fluid in a defined environment and the other measuring the properties of an environment (the borehole), it would not be obvious to modify the Yogeswaren device so as to produce a device within the scope of the present claims. To make such modifications would be to render the Yogeswaren device unfit for its intended purpose.

For all of these reasons, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claim 1. Likewise, because claims 4 and 5 depend from claim 1, they are distinguishable over Yogeswaren for the same reasons.

Similarly, claim 20 includes the same distinctions over Yogeswaren and is allowable for the same reasons. Claims 21, 23, and 25 depend from claim 20 and are also distinguishable over Yogeswaren for these reasons.

Rejections made in Numbered Paragraph 5 of the Office Action

Claims 1, 11-12, 14, 17-18, 20 and 50-51 have been rejected as anticipated by Chung et al. (US Pat. Re. 33,837 – hereinafter Chung).²

Applicants respectfully submit that the Chung is deficient as a reference for many of the same reasons set out above with respect to Yogeswaren. Primarily, the Chung device is designed for logging the properties of a subsurface formation outside of the tool, and not for measuring the properties of a fluid. This difference in purpose results in a tool that is constructed differently from the claimed device.

In particular, the Chung device lacks a reflector as claimed in claims 1 and 14. Regarding acoustic energy reflector 76, Chung states at col. 4, l. 65 to col. 6, l. 8:

"Acoustic reflector 76 will, similarly to base 64, include an upper O-ring retainer groove 116 which carries an upper O-ring 118 for sealing engagement between the outer cylindrical periphery of reflector 76 and the inner surface of housing 60. In this manner, it will be understood that an inner volume 124 (shown in FIG. 3) will thus be provided which is sealed off from the outside of housing 60 and from

² Claim 50 and 51 depend from claim 49, which is indicated to be allowable. Therefore Applicants believe that claims 50 and 51 were inadvertently included in numbered paragraph 5.

areas above and below reflector 76 and base 64, respectively.” (emphasis added).

Thus, while Chung’s reflector 76 is housed within housing 60, which is in turn within the borehole fluid, Chung’s reflector 76 is deliberately isolated from the fluid. As mentioned before and as claimed in claims 1 and 14, the present reflector is positioned in the fluid that is being analyzed. This allows the entire signal path to lie within the fluid that is being investigated, which in turn allows the acoustic signal to be used for measurement of the fluid properties.

Applicants submit that these distinctions suffice to distinguish the invention of claim 1 from the teachings of Chung. Nevertheless, claims 1 and 20 have been amended make these distinctions more explicit. Support for the amendment lies in Figure 3, which shows that the acoustic signal does not leave the device before being detected.

With respect to claim 14, Applicants respectfully submit that Chung does not include the teachings asserted by the Examiner. Claim 14 differs from claim 1, *inter alia*, in that it recites a piston. The Examiner has asserted that rod 66 is a piston. In fact, according to Chung, rod 66 is a magnetostrictive element, i.e. rod 66 is the transducer that creates the acoustic signals. See col. 6, ll. 44-54 and col. 7, ll. 18-26, which read:

FIG. 5 is a pictorial view of the rods 66-72 and corresponding coils 86-92 of the logging source 26 of FIG. 2, intended to depict functionally the electrical connection thereof and their configuration in more detail. In the preferred embodiment of the present invention, rods 66-72 are each constructed of a ferromagnetic material exhibiting the property known as the magnetostrictive phenomenon whereby when a magnetic field is applied to the material in the direction of its longitudinal axis, corresponding changes in length of the material in the direction of its longitudinal axis are produced.

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Upon opening the switch 42 and thereby de-energizing coils 86 and 90, rods 66 and 70 will return to their normal length. Accordingly, by varying the strength of the applied magnetic field, as, for example, by rapid opening and closure of switch 42, upper surfaces of rods 66 and 70 will oscillate in phase at the same frequency thereby creating two acoustic waves traveling vertically upwards toward reflector 76 along the axes of rods 66 and 70 and in the direction of central axis 28.

Because rod 66 is itself the transducer, it cannot also serve as a piston that supports the transducer, as presently claimed.

For all of these reasons, Applicants respectfully submit that claims 1, 14, and 20, as well as their dependent claims 11-12 and 17-18, are all allowable over the teachings of Chung.

Rejections made in Numbered Paragraph 6 of the Office Action

In Numbered Paragraph 6 of the Office Action, claims 2-10, 14-15, 22, 43-47 and 66-75 are rejected obvious over Yogeswaren in view of Schulte (US Pat. 5,494,102 – hereinafter Schulte).

Attorney for Applicant respectfully traverses the rejections. First, as set out in detail above, Yogeswaren does not teach all of the limitations of claim 1, 14 or 66. Schulte is directed to a hydraulic pump that does not include any sensors, transducers, or the like. Thus, the combination of Yogeswaren and Schulte does not produce a device meeting all of the limitations of the claims.

Second, the piston of Schulte reciprocates in response to alternating pressurized hydraulic fluid flow, which is absent in the present invention. One of ordinary skill in the art would have no reason to combine Schulte's pump mechanism with the claimed fluid analyzing device.

Thus, no *prima facie* case of obviousness has been established for these claims.

Rejections made in Numbered Paragraph 7 of the Office Action

In Numbered Paragraph 7 of the Office Action, claims 1-6, 19-22, 25, 35-39, 41-42, and 43 are rejected obvious over Goodwin et al. (US Pat. 6,490,916 - hereinafter Goodwin) in view of Cosentino (US Pat. 4,142,414 - hereinafter Cosentino).

Attorney for Applicant respectfully traverses the rejections.

Goodwin teaches a device and method for determining the bubble point or dew point of a fluid sample by using a transducer to induce acoustic waves in the fluid and measuring the electrical impedance in the transducer in order to detect the formation of bubbles. See, col. 9, l. 65 to col. 10, l. 38. Goodwin lacks a reflector for reflecting the acoustic waves through the fluid. Moreover, since Goodwin measures the impedance of the transducer and does not make use of the acoustic waves themselves, there would be no reason to modify Goodwin so as to include a reflector in the path of the waves.

Cosentino teaches an ultrasonic flow meter and mentions the use of a moving reflector to provide Doppler-shifted reflected sound waves. As is known in the art, the frequency of waves reflected from a moving object is shifted up or down, depending on the speed of the object and whether it is moving toward or away from the source. Because the present invention relates to a static fluid sample, moving reflectors and Doppler shifting have no relevance to the present invention whatsoever.

For these reasons, the combination of Goodwin with Cosentino does not render the present claims obvious.

Applicant further respectfully submits that the rejections of many of the dependent claims appear to be in error. For example, claim 3 recites a servomotor for driving the piston. Against this element, the Examiner cites piezoelectric crystals 340. Piezoelectric crystals are not normally considered motors and Goodwin's crystals 340 do not function as a motor, as they do not drive or provide motive force to the piston. Applicants respectfully request that the Examiner reconsider the substance of these rejections.

Concluding remarks

Applicants have addressed each ground rejection raised by the Examiner in the Office Action. Applicants respectfully submit that the current claims are in condition for allowance. Applicants therefore request that the Examiner reconsider and withdraw the rejection and allow the case to issue.

If the Examiner has any questions regarding the foregoing, he is requested to telephone the undersigned at (713) 241-1041 prior to the issuance of any written action.

Respectfully submitted,
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